



A Multi-Agent System for Coordinating International Shipping

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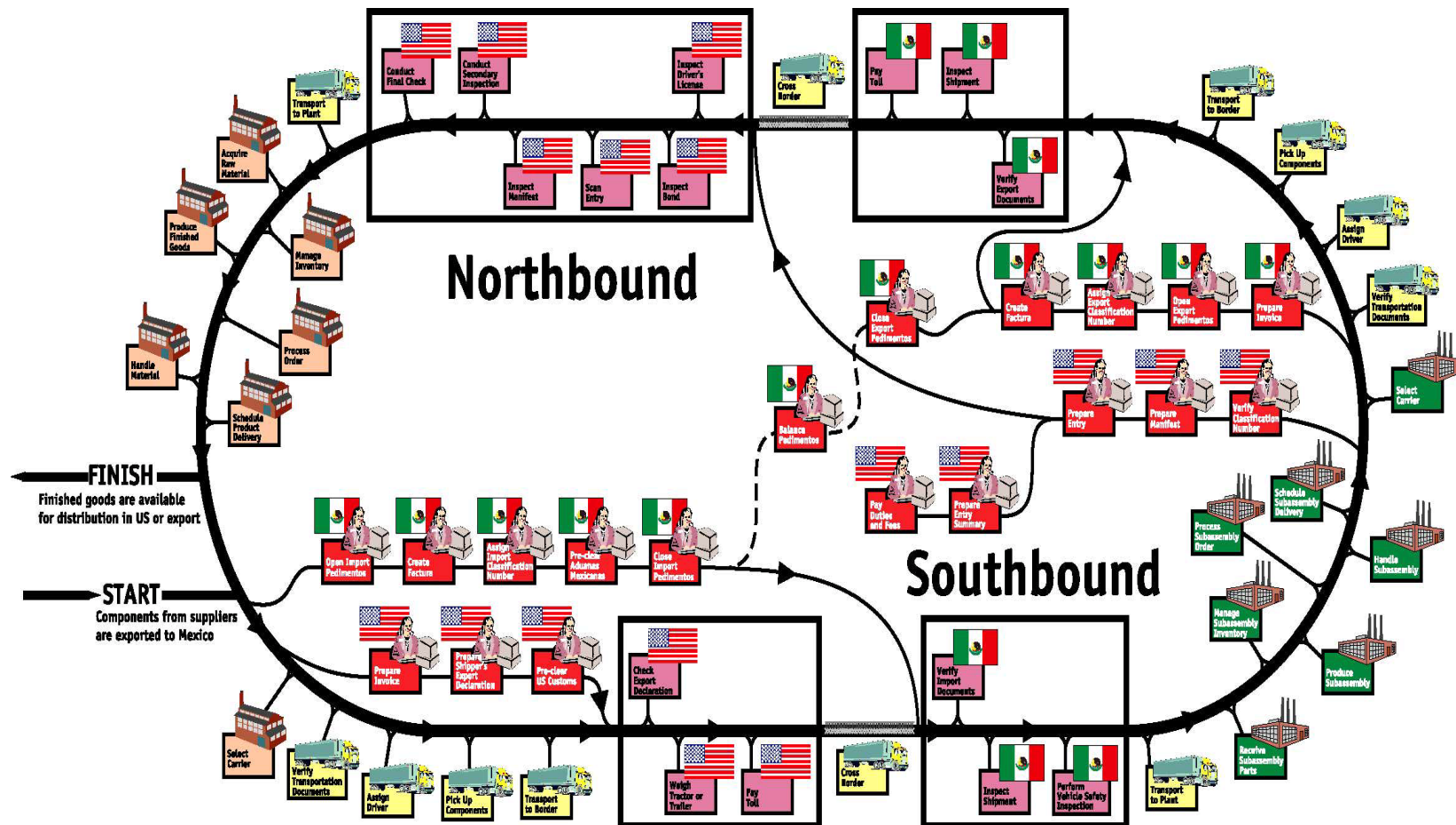


The Border Trade Facilitation System

- I Background: The Border Trade Environment (What's the problem?)
- II Motivation for a Multi-agent Architecture (Why use agents?)
- III Standard Agent Framework (How do our agents work?)
- IV Agent Tasks & Collaboration (What do our border trade agents do?)
- V Conclusions and Lessons Learned (What did we learn?)



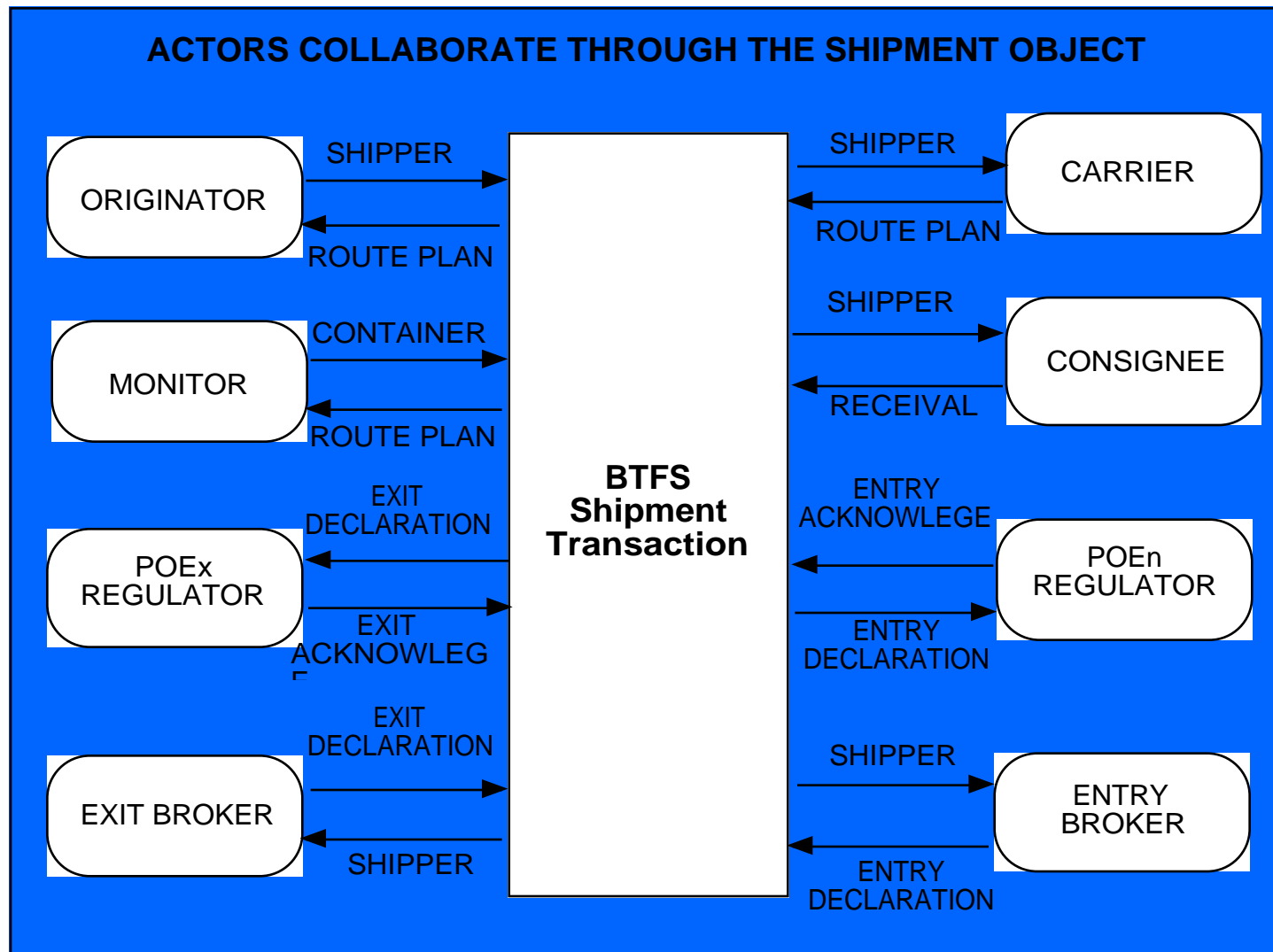
I. Background: The Border Crossing Environment

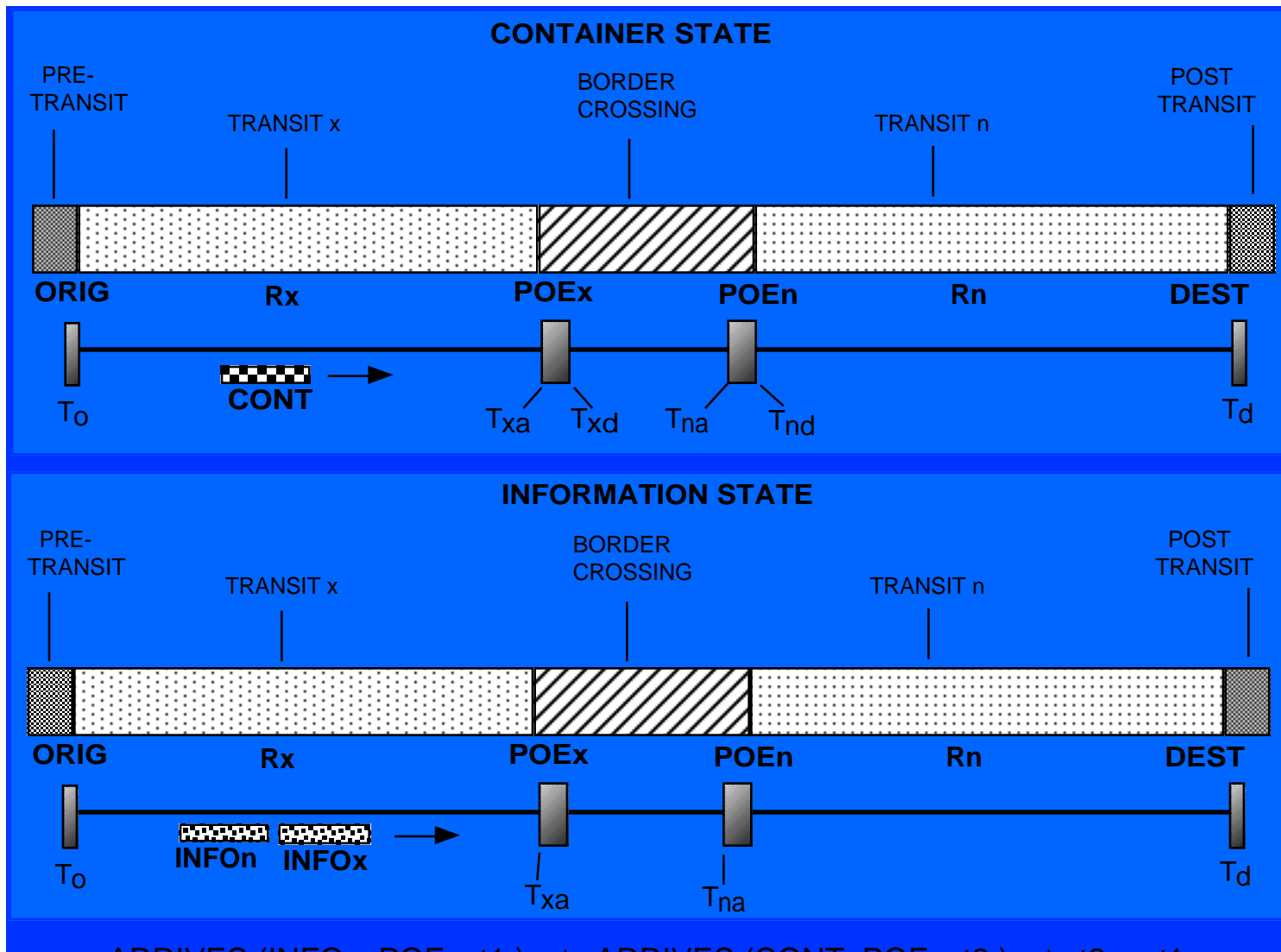


The Maquiladora Shipping Process

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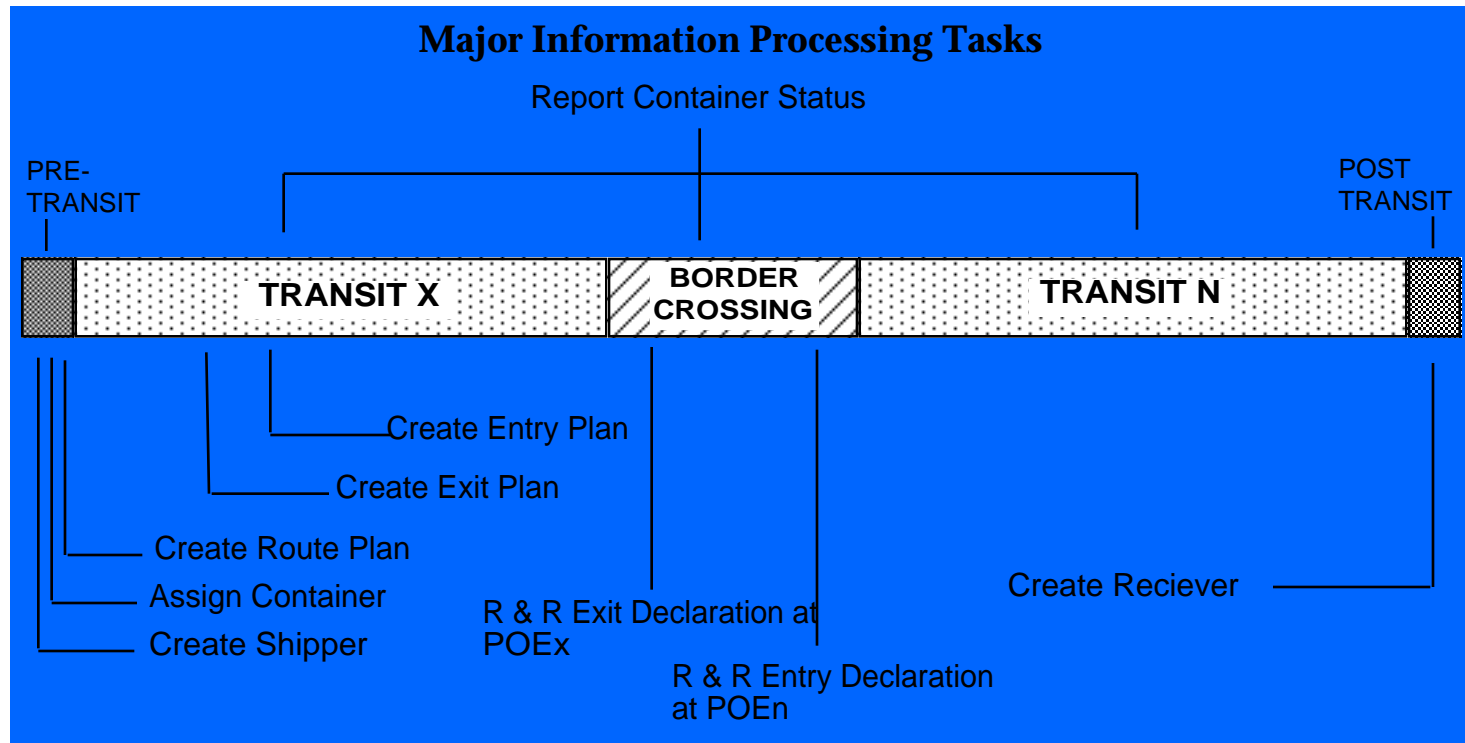
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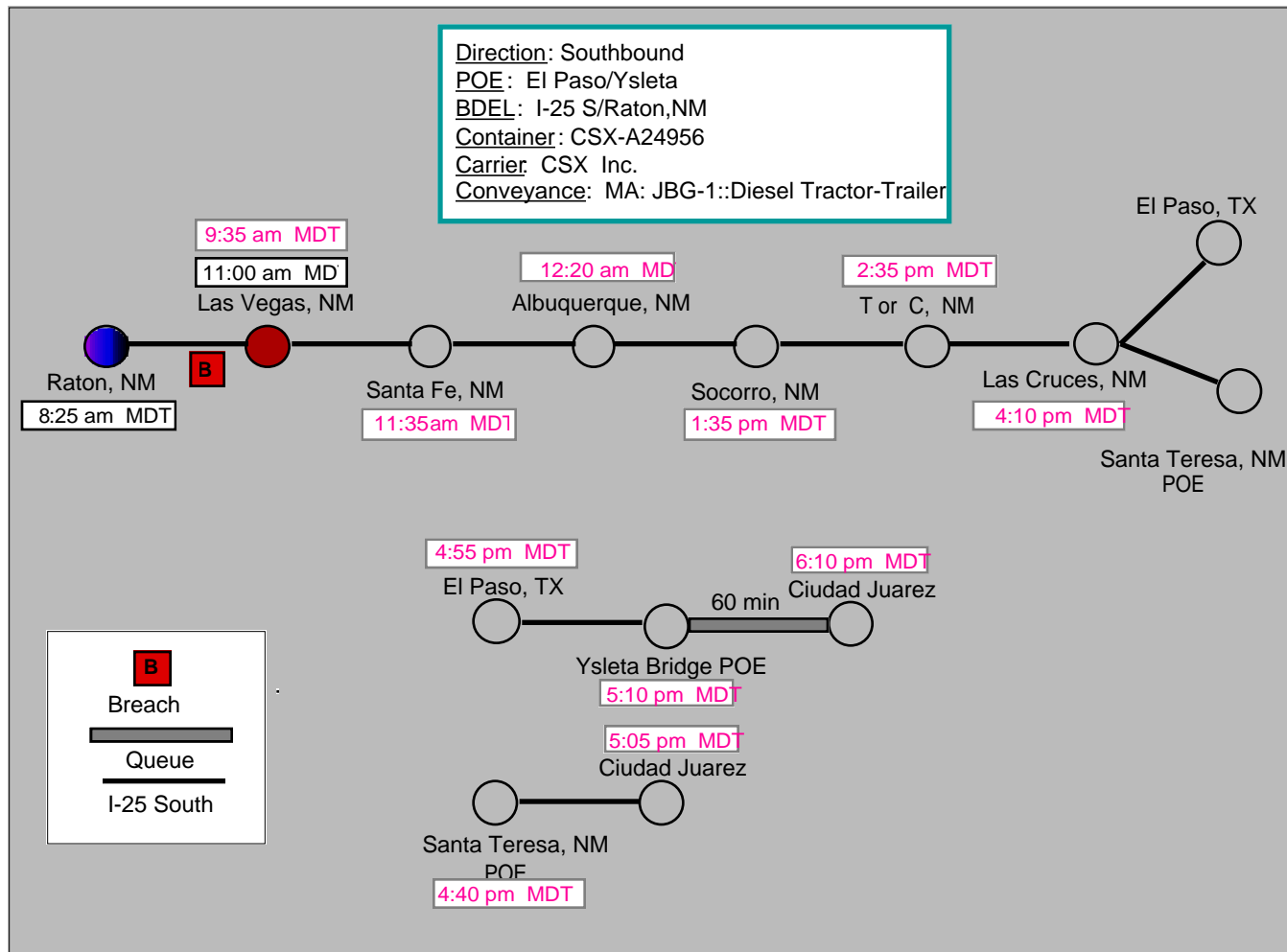




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II. Motivation for A Multi-agent Architecture



Stakeholder Survey

Automated Documentation (80)

System Integration (80)

Shipment Tracking (60)

Information Security (60)

Process Improvements (40)



System Attributes

Distributed System

Decentralized Decision Making

Specialized Knowledge & Expertise

Proprietary Data & Knowledge

Collaborative Enterprise

USG & Commercial Security



Allocation of Agents

Problem is naturally partitioned according to commercial entity and government regulator

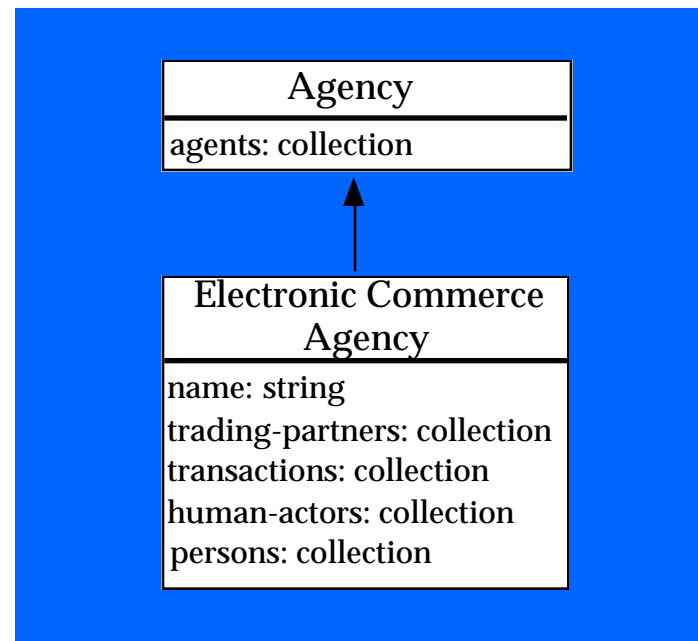
Agents are allocated to generic tasks:

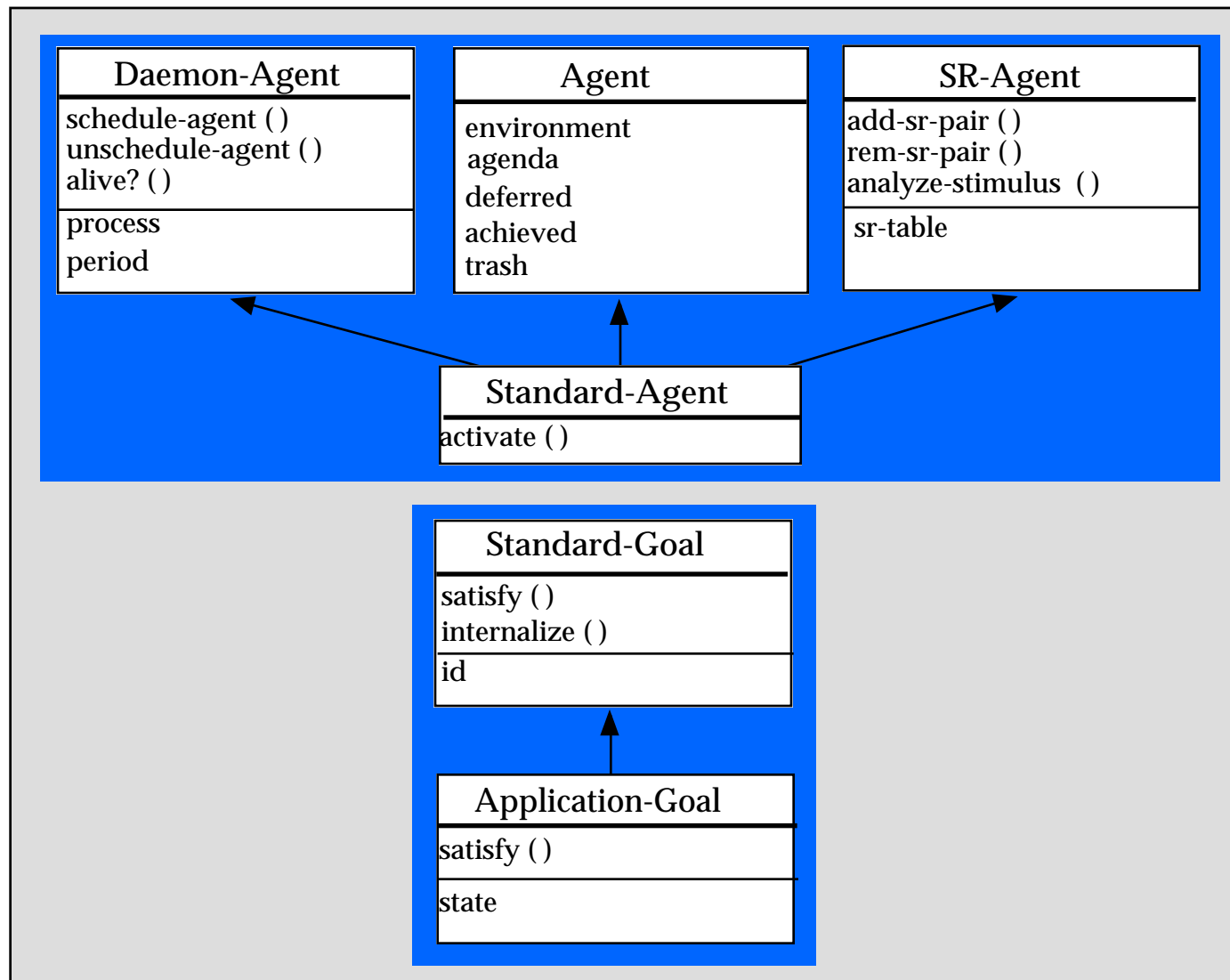
- Elicitation
- Mediation
- Delegation
- Negotiation
- Monitoring

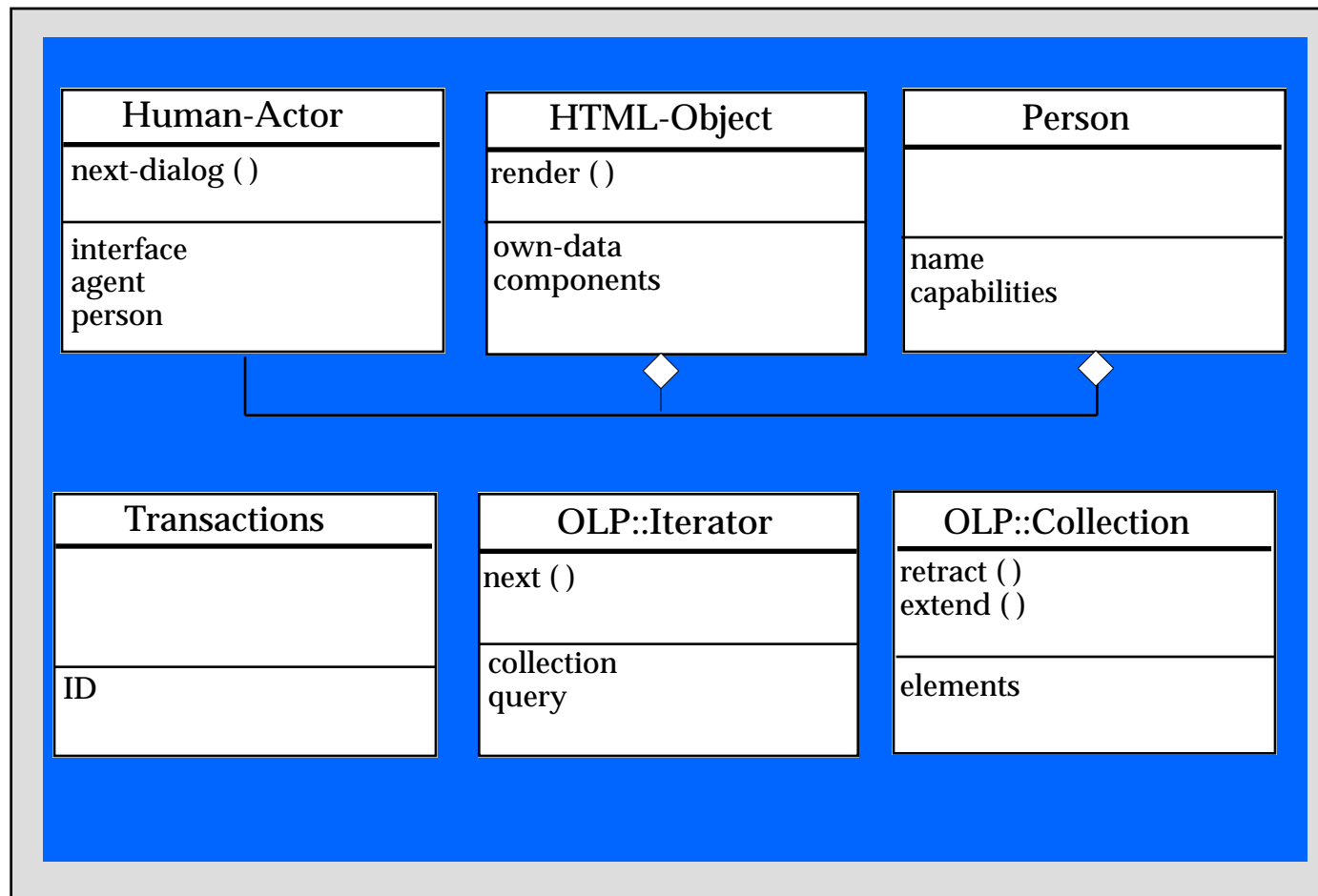
Agents are allocated to capture business processes



III. Standard Agent Framework

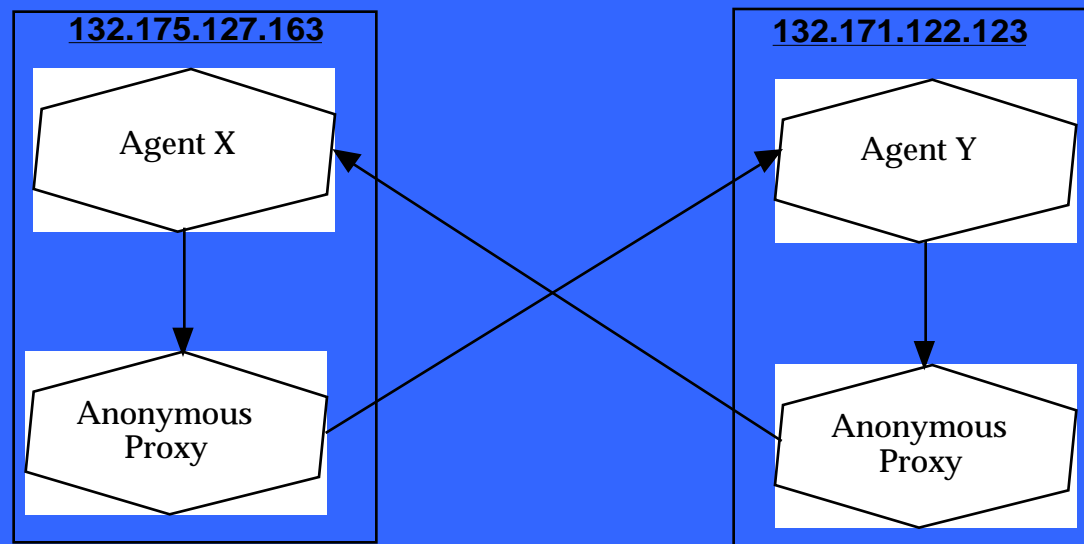


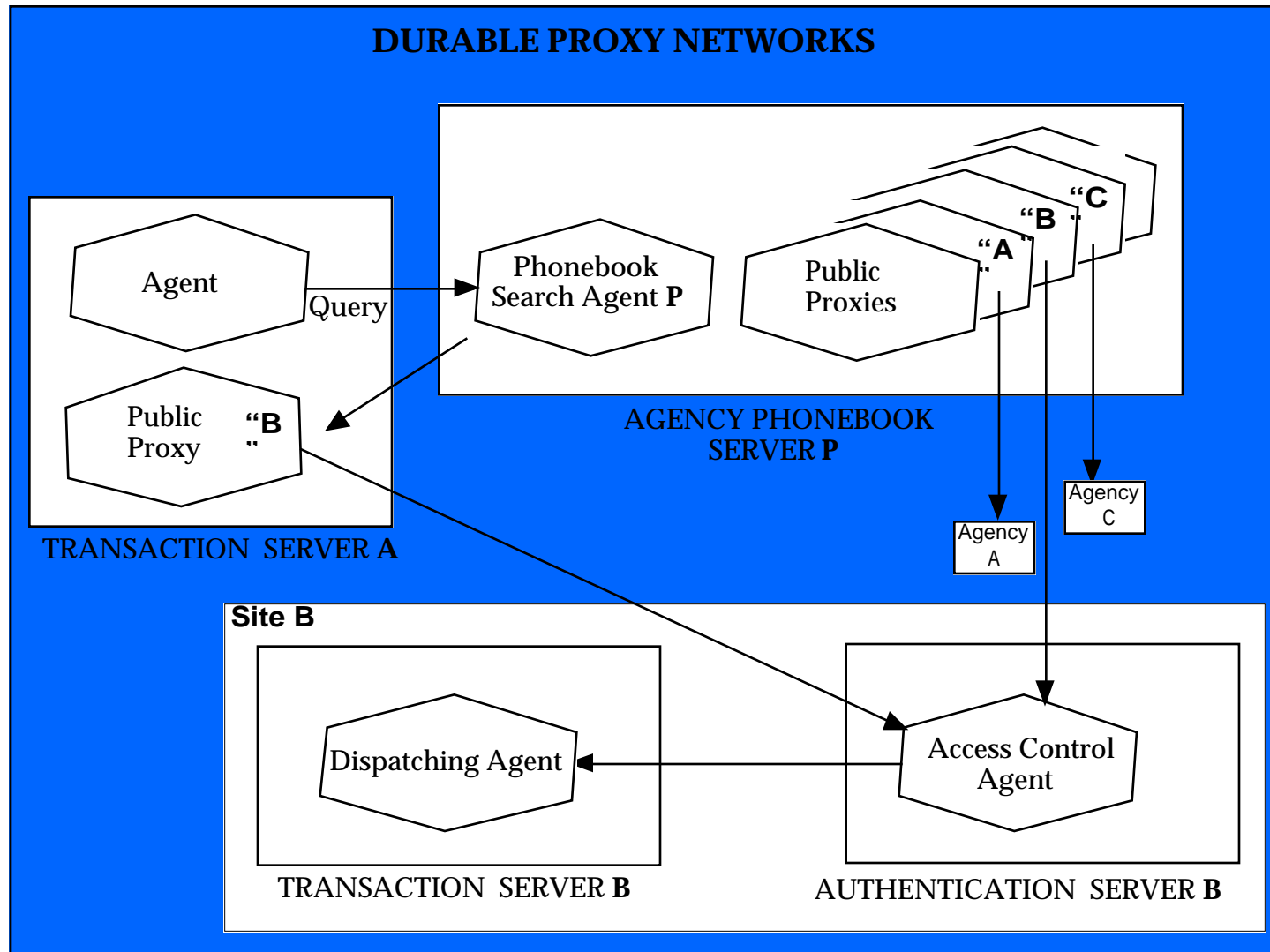


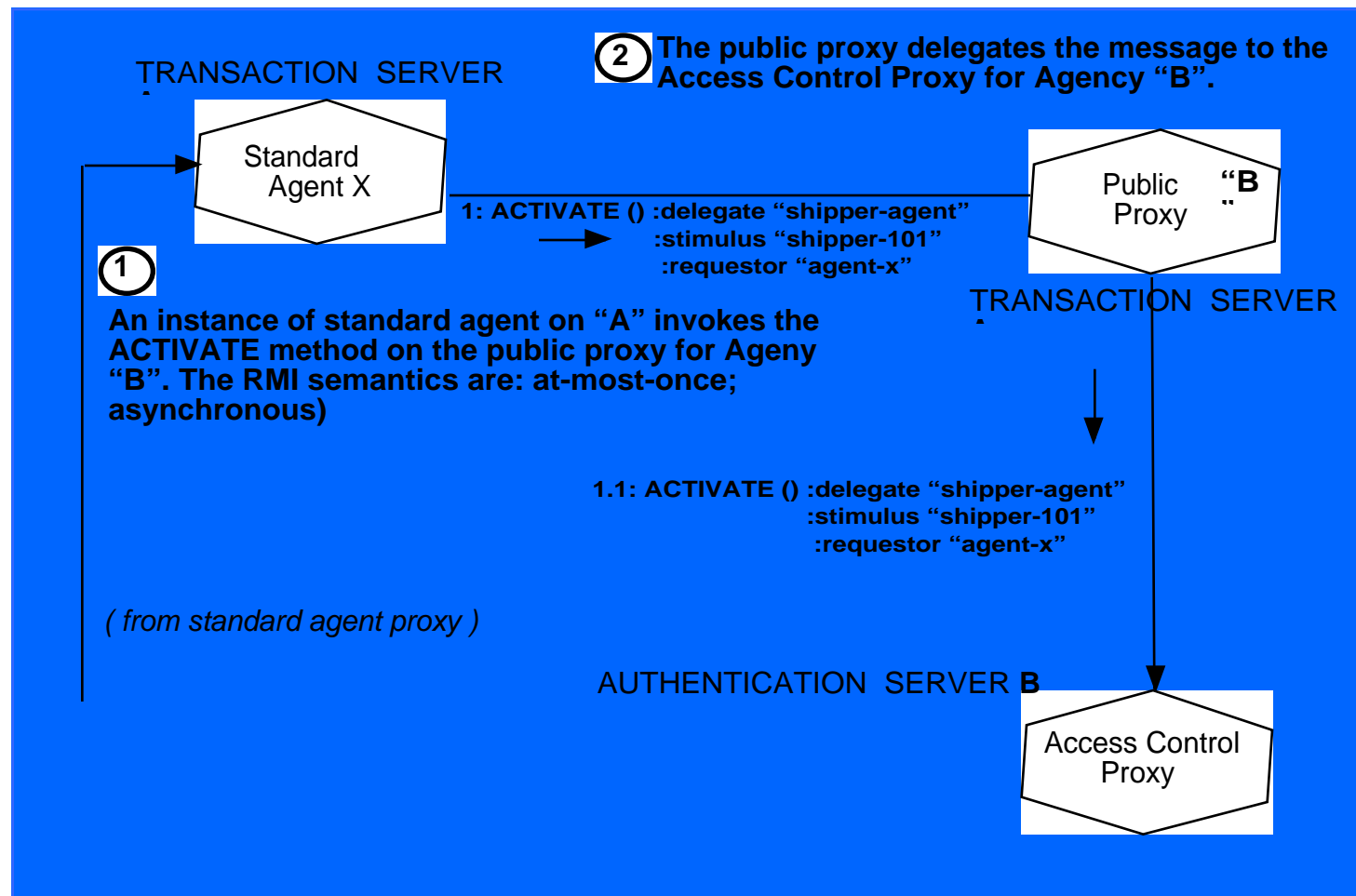


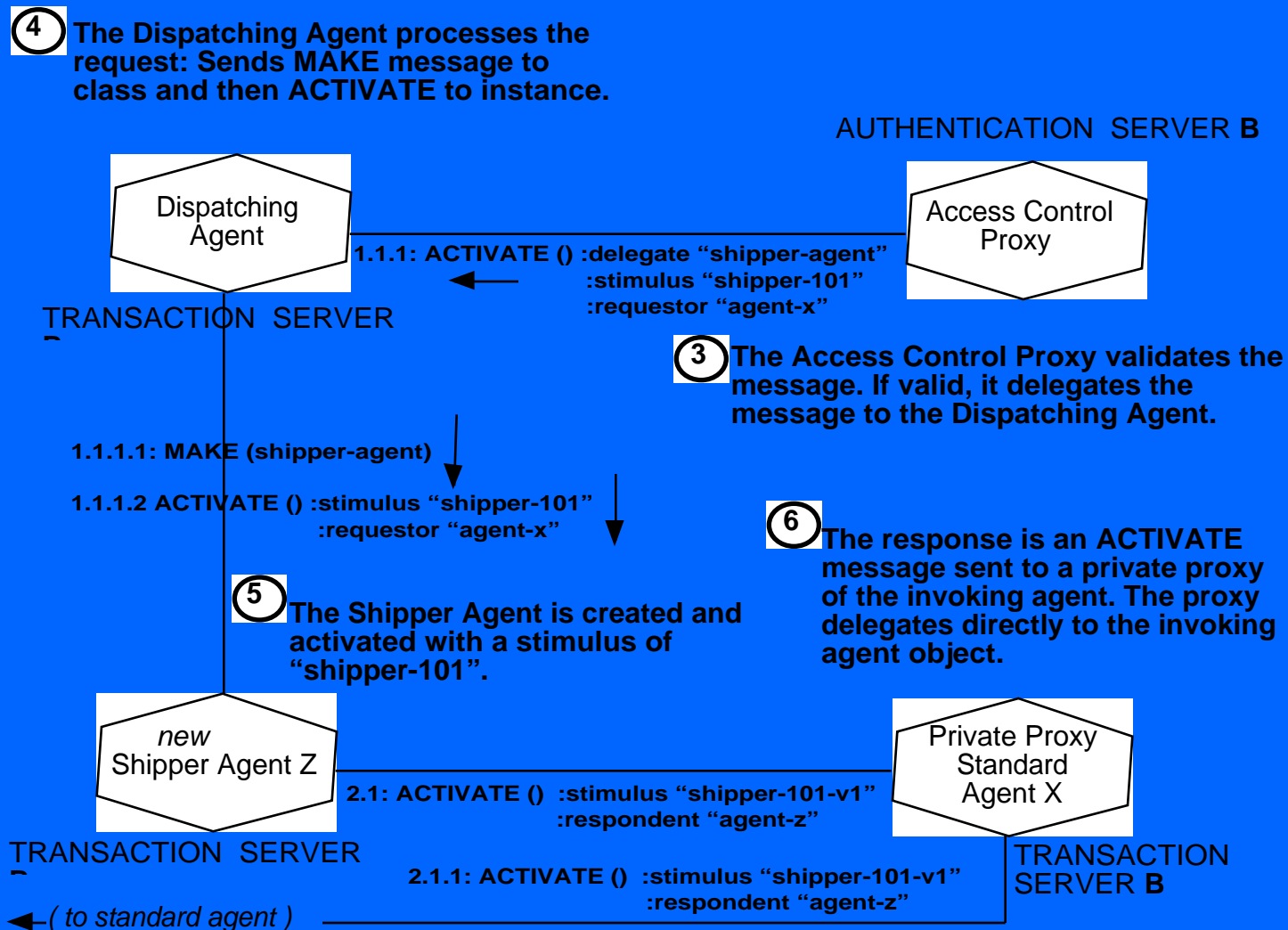


AGENT ASSOCIATION VIA “CROSS-BAR”



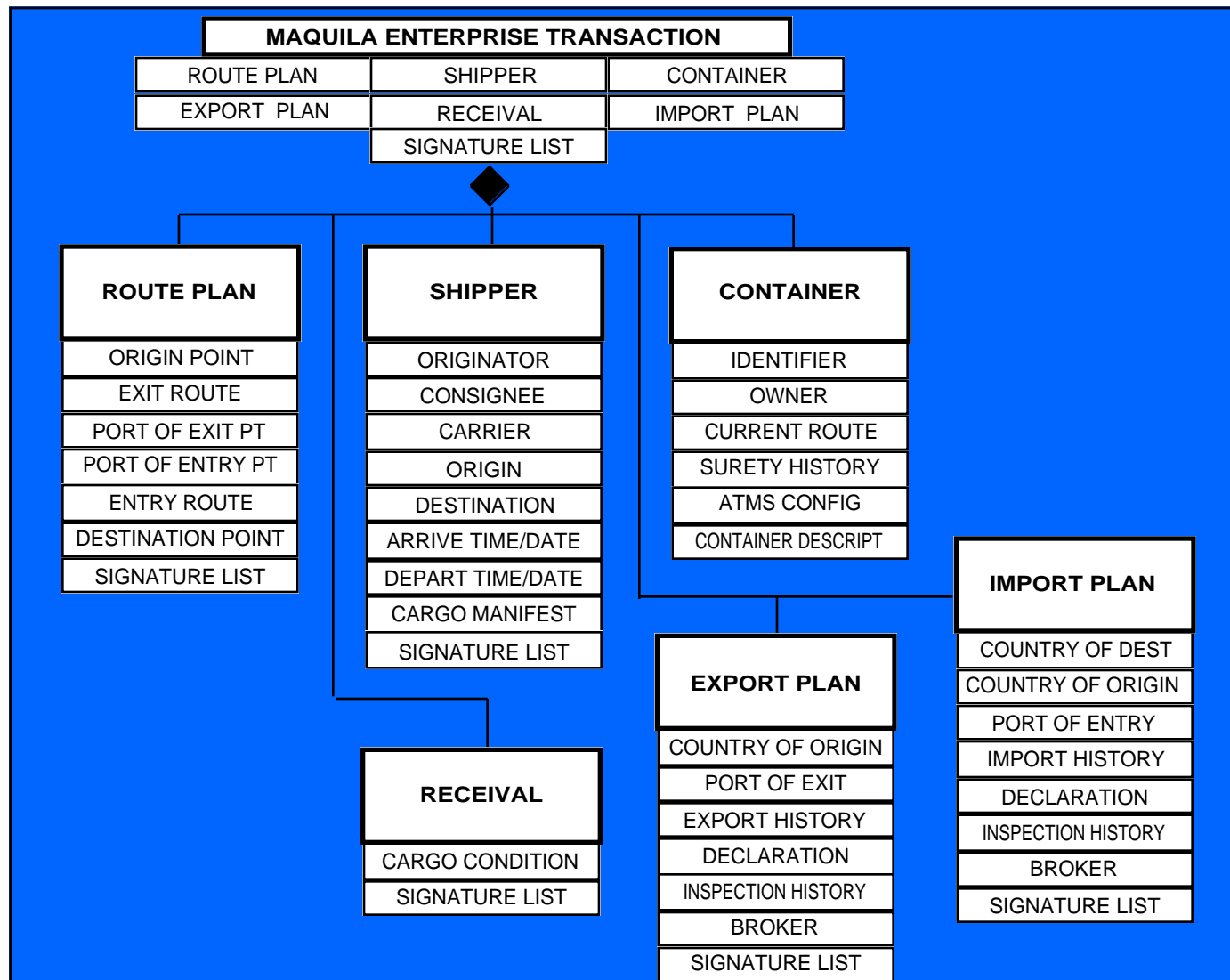








IV. Agent Tasks & Collaboration

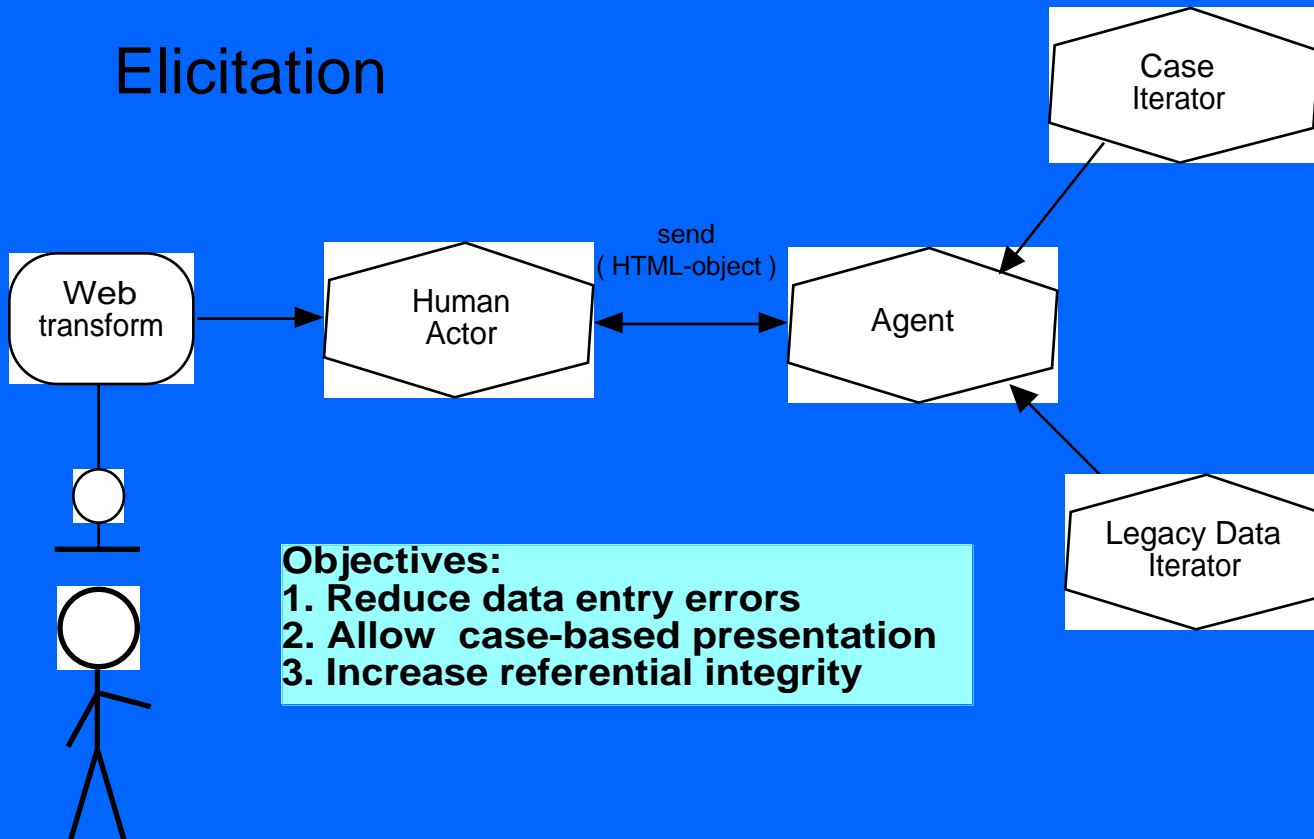


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Elicitation



[illegible]

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Netscape: pedimento

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Location: file:///LRP's%20Work%20IP/BTFS%20Alpha-6-2/BTFS/Mexican%20documents/pedimento-de-exportacion.html

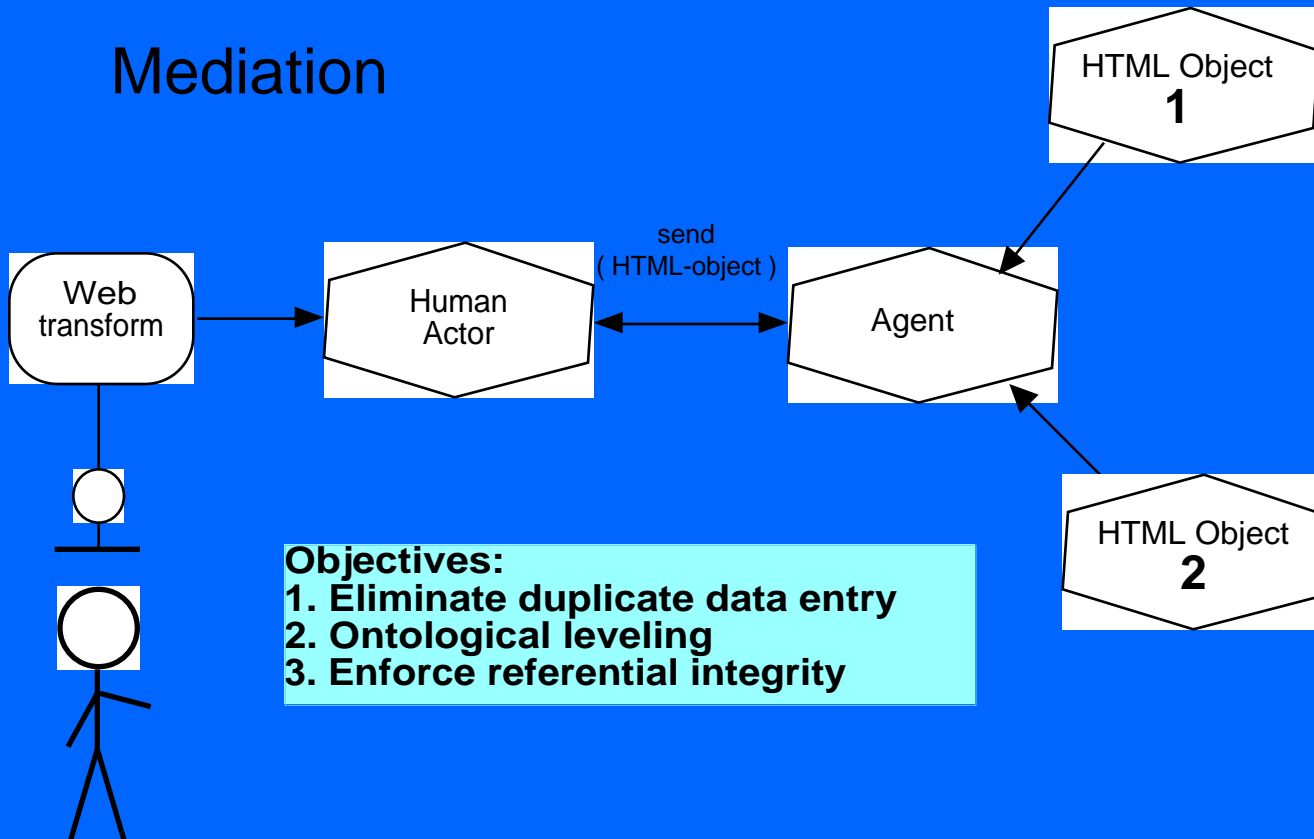
Iniciar un Nuevo Pedimento de Exportación

Pedimento Consolidado? ☐ Sí

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Tipo de Operación: 2	Clave Pedimento: A1 T.C.:
Aduana/SEC: 072	Factor Moneda Extranjera: 1
Fecha Present: 27/5/97	Transporte: 7 Carretera Peso: 201 kg.
R.F.C.: WIR041294j1h	País comprador: G8 País de Origen: N3
Exportador Nombre y Domicilio:	
Nombre: Wire Components S.A. de C.U.	
Domicilio: 1201 Parque Industrial Juárez	
Ciudad/Estado: Ciudad Juárez, Chih.	Código: 32630
Facturas: (1) T07478	
Fechas: 27/5/97	
Forma de Facturación: F.O.B.	

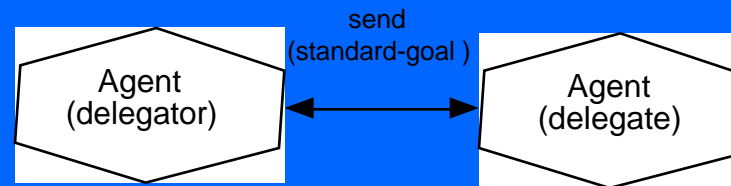


Mediation





Delegation

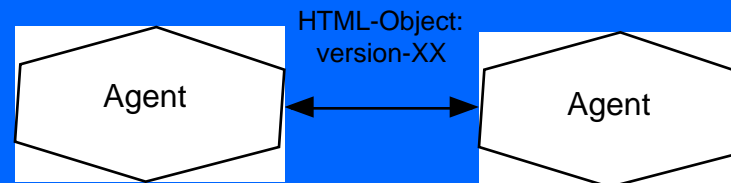


Objectives:

1. Delegate goal to other agent
2. Monitor goal satisfaction
3. Contingency action on failure



Negotiation

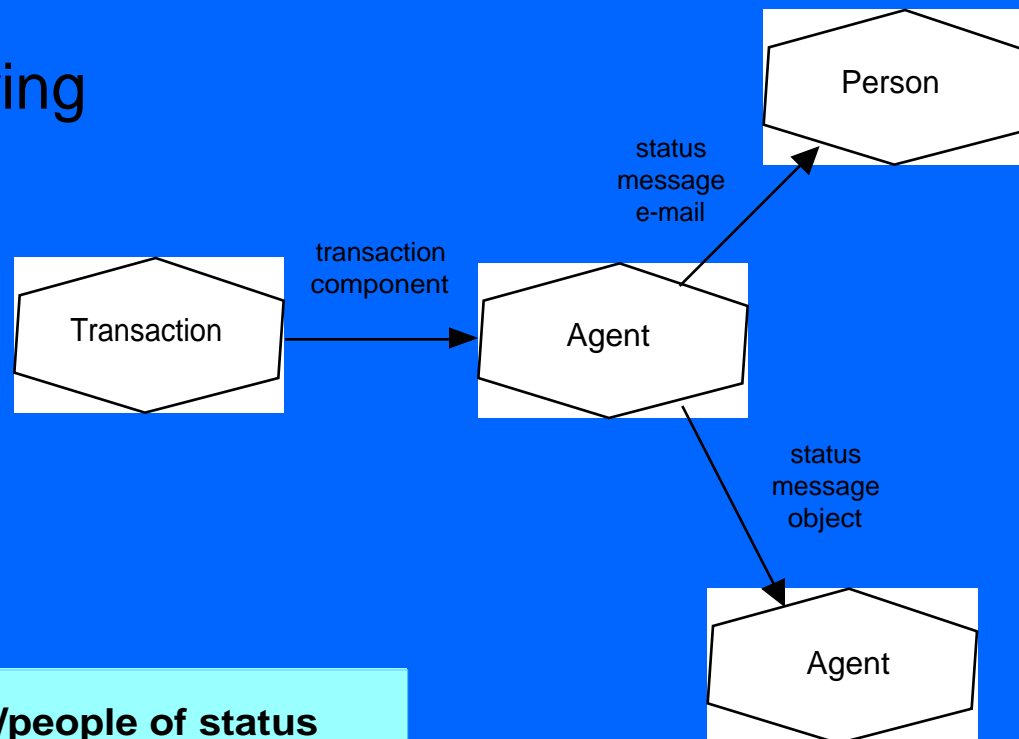


Objectives:

1. Settle on document fields
2. Provide authentication
3. Provide non-repudiation



Monitoring



Objectives:

1. Notify agents/people of status
2. Monitor transaction progress
3. Monitor physical state
4. Coordinate contingency actions



V. Conclusions & Lessons Learned



Lessons Learned

Industrial-grade multi-agent systems require

- 1. Sophisticated object-oriented substrate**
- 2. High quality software engineering process**
- 3. Knowledge engineering methodology**
- 4. Extensive and expensive requirements analysis**
- 5. Agent development framework**



Conclusions

- 1. Agent-oriented system development is superior to client-server**
- 2. Major barriers to agent-based E-commerce system deployment are cultural**
- 3. Legacy data is a pernicious problem**
- 4. Agent theory and technology are mature enough for successful application to large-scale E-commerce systems**